

000000	TTTTTTTTTT	SSSSSSSS	PPPPPPPP	000000	WW	WW	CCCCCCCC	JJ
000000	TTTTTTTTTT	SSSSSSSS	PPPPPPPP	000000	WW	WW	CCCCCCCC	JJ
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
00	00	TT	SS	PP	00	00	WW	WW
000000	TT	SSSSSSSS	PP	000000	WW	WW	CCCCCCCC	JJJJJJJJ
000000	TT	SSSSSSSS	PP	000000	WW	WW	CCCCCCCC	JJJJJJJJ

LL		SSSSSSSS
LL		SSSSSSSS
LL		SS
LLLLLLLL		SSSSSSSS
LLLLLLLL		SSSSSSSS

(2)	47	HISTORY	; Detailed Current Edit History
(3)	62	DECLARATIONS	
(4)	98	OTSSPOWCJ	- COMPLEX*8 ** INTEGER*4

0000 1 .TITLE OTSSPOWCJ - COMPLEX ** INTEGER*4 power routine
0000 2 .IDENT /1-004/ ; File OTSPWCJ.MAR Edit: SBL1004
0000 3 *****
0000 4 *
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0000 22 *
0000 23 *
0000 24 *****
0000 25
0000 26
0000 27 : FACILITY: Language support library - user callable
0000 28 ++
0000 29 : ABSTRACT:
0000 30
0000 31 : COMPLEX base to INTEGER*4 power.
0000 32 : Floating overflow can occur.
0000 33 : Undefined exponentiation can occur if
0000 34 : base = (0.,0.) and exp <=0
0000 35
0000 36 --
0000 37
0000 38 : VERSION: 0
0000 39
0000 40 : HISTORY:
0000 41 : AUTHOR:
0000 42 : Jonathan M. Taylor, 29-jun-77: Version 0
0000 43
0000 44 : Edit history for version 0
0000 45

0000 47 .SBTTL HISTORY ; Detailed Current Edit History
0000 48
0000 49
0000 50 : Edit History for Version 0 of OTSSPOWCJ
0000 51 : 0-2 change MTH\$SError to MTH\$SIGN JMT 5-OCT-77
0000 52 : 0-6 - Change FOR\$FLAG_JACKET to MTH\$FLAG_JACKET. TNH 17-July-78
0000 53 : 0-7 - Fix bug giving divide fault, or wrong results for
some negative powers. Also clean up comments.
0000 54 : SPR 20364 SBL 27-Oct-78
0000 55 : 1-001 - Change version number to 1 and MTH__UNEXP
to MTH\$K_UNEXP. JBS 07-DEC-78
0000 56 : 1-002 - Add "" to the PSECT directive. JBS 22-DEC-78
0000 57 : 1-003 - Declare externals. SBL 17-May-1979
0000 58 : 1-004 - Use general mode addressing. SBL 30-Nov-1981
0000 59 :
0000 60 : 1-004 - Use general mode addressing. SBL 30-Nov-1981

```
0000 62      .SBttl  DECLARATIONS
0000 63
0000 64      : INCLUDE FILES:
0000 65
0000 66      : EXTERNAL SYMBOLS:
0000 67
0000 68
0000 69      : DSABL  GBL
0000 70      : EXTRN  MTH$$$SIGNAL
0000 71      : EXTRN  OTSSDIVC
0000 72      : EXTRN  MTH$K_UNDEXP
0000 73
0000 74
0000 75
0000 76      : MACROS:
0000 77
0000 78
0000 79
0000 80      : EQUATED SYMBOLS:
0000 81
0000 82      : base = 4
0000 83      : exp = 12
0000 84
0000 85
0000 86      : OWN STORAGE:
0000 87
0000 88
0000 89
0000 90      : PSECT DECLARATIONS:
0000 91
0000 92
0000 93      .PSECT  _OTSSCODE PIC,SHR,LONG,EXE,NOWRT
0000 94
0000 95      ; program section for OTSS code
0000 96
```

0000 98 .SBTTL OTSSPOWCJ - COMPLEX*8 ** INTEGER*4
0000 99 ;***
0000 100 ++
0000 101 FUNCTIONAL DESCRIPTION:
0000 102
0000 103 COMPLEX result = COMPLEX base ** INTEGER*4 exponent
0000 104 The COMPLEX result is given by:
0000 105
0000 106 base exponent result
0000 107 any >0 PRODUCT (base * 2**i) where
0000 108 i is each non-zero bit in
0000 109 exponent.
0000 110
0000 111 (0., 0.) <=0 Undefined exponentiation.
0000 112
0000 113 not (0., 0.) <0 PRODUCT (base * 2**i) where
0000 114 i is each non-zero bit in
0000 115 exponent.
0000 116
0000 117 not (0., 0.) =0 (1.0, 0.0)
0000 118
0000 119
0000 120
0000 121 Floating overflow can occur.
0000 122 Undefined exponentiation occurs if base is 0 and
0000 123 exponent is 0 or negative.
0000 124
0000 125 CALLING SEQUENCE:
0000 126
0000 127 Power.wfc.v = OTSSPOWCJ (base.rfc.v, exponent.rl.v)
0000 128
0000 129 INPUT PARAMETERS:
0000 130 The base input parameter is standard FORTRAN COMPLEX.
0000 131 The exponent input parameter is a signed longword integer.
0000 132 Both input parameters are CALL BY VALUE.
0000 133
0000 134 IMPLICIT INPUTS:
0000 135 NONE
0000 136
0000 137 OUTPUT PARAMETERS:
0000 138 NONE
0000 139
0000 140 IMPLICIT OUTPUTS:
0000 141 NONE
0000 142
0000 143 FUNCTION VALUE:
0000 144 COMPLEX base ** INTEGER*4 exponent
0000 145
0000 146
0000 147 SIDE EFFECTS:
0000 148 SIGNALS SSS_ARITH with floating overflow hardware code if
0000 149 floating overflow.
0000 150 SIGNALS MTH\$ UNDEXP (82 = ' UNDEFINED EXPONENTATION') if
0000 151 base is 0 and exponent is 0 or negative.
0000 152
0000 153
0000 154 --

007C 0000 156 .ENTRY OTSSPOWCJ, ^M<R2,R3,R4,R5,R6>
 52 04 AC 7D 0002 157 ; disable integer overflow
 54 0C AC D0 0006 158 ; R2/R3 gets COMPLEX base
 03 18 000A 160 ; R4 = longword exponent
 0C 54 00 E5 000F 161 ; R4 = : exponent :
 50 52 7D 0013 162 15: BGEQ 1S
 54 54 FF 8F 9C 0016 163 BBCC #0, R4, EVEN
 52 53 0029 164 MOVQ R2, R0
 58 13 001B 165 ROTL #1, R4, R4
 27 11 001D 166 BEQL DONE
 001F 167 BRB SQUAR1
 001F 168 EVEN:
 54 50 08 70 001F 169 MOVD #1, R0
 FF 8F 9C 0022 170 ROTL #1, R4, R4
 1D 12 0027 171 BNEQ SQUAR1
 52 53 0029 172 TSTF R2
 48 12 002B 173 BNEQ DONE
 53 53 002D 174 TSTF R3
 44 12 002F 175 BNEQ DONE
 0031 176
 0031 177 UNDEFINED:
 50 01 0F 79 0031 178 ASHQ #15, #1, R0
 7E 00 8F 9A 0035 179 MOVZBL #MTHSK_UNDEXP, -(SP)
 00000000'GF 01 FB 0039 180 CALLS #1, G^MTHSSIGNAL
 0040 181
 04 0040 182 RET
 0041 183
 54 54 FF 8F 78 0041 184 SQUAR:
 0046 185 ASHL #1, R4, R4 ; R4 = :reduced exponent: / 2
 0046 186 : R2/R3 = square current base
 0046 187
 0046 188 SQUAR1:
 55 53 52 45 0046 190 MULF3 R2, R3, R5 ; R5 = tmp = RP(base)*IP(base)
 52 52 44 004A 191 MULF R2, R2 ; R2 = RP(base)**2
 53 53 44 004D 192 MULF R3, R3 ; R3 = IP(base)**2
 53 52 53 42 0050 193 SUBF R3, R2 ; R2 = RP(base)**2 - IP(base)**2
 55 55 41 0053 194 ADDF3 R5, R5, R3 ; R3 = 2*RP(base)*IP(base)
 E7 54 E9 0057 195 BLBC R4, SQUAR ; branch if next exponent bit is 0
 005A 196 : R0/R1 = partial result * current power of base
 005A 197
 55 53 50 45 005A 199 MULF3 R0, R3, R5 ; R5 = tmp = RP(part) * IP(base)
 50 52 44 005E 200 MULF R2, R0 ; R0 = RP(part) * RP(base)
 56 53 51 45 0061 201 MULF3 R1, R3, R6 ; R6 = tmp = IP(part) * IP(base)
 50 56 42 0065 202 SUBF R6, R0 ; R0=RP(part)*RP(base)-IP(part)*IP(base)
 51 52 44 0068 203 MULF R2, R1 ; R1 = IP(part) * RP(base)
 51 51 55 40 006B 204 ADDF R5, R1 ; R1=IP(part)*RP(base)+RP(part)*IP(base)
 54 54 FF 8F 78 006E 205 ASHL #1, R4, R4 ; R4 = :reduced exponent: / 2
 D1 12 0073 206 BNEQ SQUAR1 ; loop if more exponent bits left
 0075 207 DONE:
 OC AC D5 0075 208 TSTL exp(AP) ; test exponent sign
 15 18 0078 209 BGEQ POWCJ ; done if positive
 50 53 007A 210 TSTF R0 ; test RP(result)
 04 12 007C 211 BNEQ RECIP ; if non-0, OK to take reciprocal
 51 53 007E 212 TSTF R1 ; RP(result) was 0, test IP(result) ;---

AF 13 0080 213 BEQL UNDEFINED ; undefined (0.0+0.0i) ** -n
00000000'GF 7E 50 0082 214 RECIP: 0082 214 RECIP: ; undefined (0.0+0.0i) ** -n
7E 08 70 0085 215 MOVQ R0, -(SP) ; second arg pair is divisor
04 FB 0088 216 MOVD S^#1, -(SP) ; push (1.,0.) on stack
008F 217 CALLS #4, G^OTSSDIVC ; R0/R1 = reciprocal
04 008F 218 POWCJ: RET ; result in R0/R1
0090 220 .END ;++-
0090 221 .END

OTSSPOWCJ
VAX-11 Macro Run Statistics

- COMPLEX ** INTEGER*4 power routine ^{D 12} 16-SEP-1984 01:56:54 VAX/VMS Macro V04-00
6-SEP-1984 11:28:00 [MTHRTL.SRC]OTSSPOWCJ.MAR;1 Page 8 (5)

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS\$:OTSSPOWCJ/OBJ=OBJ\$:OTSSPOWCJ MSRC\$:OTSSPOWCJ/UPDATE=(ENH\$:OTSSPOWCJ)

OTS
2-0

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VAX/VMS V4.0

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